

Plecoptera from High Altitudes and a New Species of *Leuctra* (Leuctridae) ¹

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ABSTRACT

Five species of stoneflies have been previously recorded from the alpine zone above timberline in the White Mountains of New Hampshire. Two of these were probably carried up by wind and do not survive in the area. Two additional species of *Nemoura* were found existing there. Eleven species were collected near or above timberline in Wyoming, two of these being new records for Wyoming. The alpine zone in the east has relict arctic populations with occasional incursions of temperate species. Alpine zones in the west have populations that are continuous north and south. *Leuctra laura* new sp. is described. A key to *Leuctra* males of the northeast is given.

High mountain areas are of considerable interest in the study of populations for they allow intrusions of northern species into more southern areas. The alpine zone of the White Mountains is a restricted area that has been under scrutiny of biologists since the late eighteenth century. The higher reaches of the western cordillera cover a vast expanse that have been only imperfectly examined. Recently I have collected stoneflies near and above timberline in both the Presidential range of New Hampshire and the Wind River range of Wyoming. Several stoneflies have been recorded from the former, apparently none from the latter.

Alexander (1940) has given a fine summary of the biology and geology of the Mt. Washington area of New Hampshire so no detailed descriptions will be given here. The following stoneflies have been previously recorded from the alpine zone of Mt. Washington: *Diura nanseni* (Kempny) (Perlodidae), *Leuctra variabilis* Hanson, *Nemoura nigritta* Provancher (Nemouriolae), *Leuctra tenuis* (Pictet) and *Arcynopteryx compacta* (MacLachlan) (Perlodidae). The first two species were found at the Lakes of the Clouds (el. 5,000 feet) or the outlet to it. An additional record from this spot is *Nemoura trispinosa* Claassen collected by me on June 28th. These stoneflies were numerous and emerging as adults at noontime. As might be expected, they resembled specimens from the north in Quebec rather than western populations in Illinois. The adults were all macropterous but did not fly. If disturbed, they lifted their wings, the ever present wind

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carried them a few feet, whereupon they folded their wings, dropped to the ground and ran into rock cracks or other shelter.

Nemoura washingtoniana Claassen was originally collected from "Mt. Washington" but without specific data to enable it to be placed by life zone. It is of interest therefore that I captured one male and two females from a small brooklet coming off the snowfields over timberline above the head-wall of Tuckerman Ravine at about 5,100 feet.

Slosson (1895, 1897) recorded two stoneflies from above timberline on Mt. Washington and probably from the summit as her collecting was apparently restricted to the vicinity of the hotel at the top of the mountain (el. 6,288 feet). *Nemoura nigritta* (= *N. delosa*) ranges from Florida to southern Quebec. It is perhaps the most common *Nemoura* in southern New England and it would therefore seem likely that *nigritta*, being a more southern species and common in streams, was a likely candidate to be carried by winds to the summit, rather than breeding in the little water available above timberline. *Leuctra tenuis* recorded by Mrs. Slosson in 1895 may also be a chance capture. Most *Leuctra* fly readily and I have taken them one-half mile from the nearest stream. I have found the closely related *L. tenella* in a stream on the wooded slope of Mt. Washington and, if flying near timberline, could be easily carried upwards by the wind currents. In the absence of contrary evidence, *L. tenuis* should also not be considered an inhabitant of the upper slopes.

Three different elements then make up the Plecoptera fauna of the alpine zone in the White Mountains: a) casual visitors—lowland species of more southern range taken by convection air currents and deposited in the area but which cannot survive (example—*Nemoura nigritta*); b) temperate species—species whose range is continuous latitudinally to the north and can survive in the alpine zone as equivalent to the northern edge of its range. If the local population is wiped out by an extra severe winter or other catastrophe, it can be replenished by immigrants from the same stream farther down the slope in the Hudsonian or Canadian zones (example—*Nemoura trispinosa*); c) northern species—species whose range is discontinuous to the north and the White Mountains represent an isolated southern remnant of an otherwise circumpolar distribution. If destroyed in the local area, there can be no immediate replacement (example—*Diura nanseni washingtoni*).

Tuckerman Ravine, a protected glacial cirque on the eastern slope of the range, has been extensively collected for stoneflies. *Arcynopteryx compacta*, a transcontinental arctic species, has been taken there as has a single female *Nemoura*, possibly *oregonensis*. Both of these represent isolated outposts of more northern or western species.

Tuckerman Ravine also contains the following new species:

***Leuctra (Leuctra) laura* NEW SPECIES**

(Figs. 1, 3, 4)

Male: Light brown in color; prosternal sclerites and wing venation typical of subgenus; first six abdominal segments unexceptional, seventh tergite bears a broad sclerotized lobe that is barely raised above the surface and extends two-thirds the way across the tergite, a membranous area extends from the posterior margin of the tergite forward on each side of the lobe; the eighth tergite bears a trifurcate process reaching (in dorsal view) almost to the hind margin, the lateral teeth of this process sharply pointed and raised above the surface of the tergite, the center tooth smaller and appressed to the surface so that it turns slightly downward; the posterior membranous margin of the tergite drops sharply down from the trifurcate process, this membranous area extends anteriorly on each side of the process; the ninth tergite largely membranous except for a lightly sclerotized area medially; the vesicle (ventral lobe) of the ninth sternite setiferous and twice as long as wide, the center portion of the sternite flattened, somewhat membranous and slightly recessed medially, the terminal lobe sharply produced; paraprocts curved and of approximate equal width throughout; the titillators shorter than the paraprocts and only slightly curved. Length to tip of wings 8.5 mm.

The holotype male was taken by sweeping the foliage over Cutler's Brook at the base of Tuckerman Ravine (el. 3,300 feet), Mt. Washington, N. H., June 28, 1969. It will be placed in the United States National Museum, type number 70772.

Female: unknown. There were two distinctive *Leuctra* females collected with the holotype, either of which could be the female of this species. The most likely specimen, based on size and color, is illustrated in Fig. 2 and described as follows:

Light brown in color; prosternal sclerites, abdominal tergites and wing venation typical of subgenus; subgenital plate of the eighth sternite slightly produced into two broad, flattened lobes with a shallow narrow notch between them; a lighter colored area extends forward from this notch to the anterior margin of the sternite so forming an irregular longitudinal stripe; cerci setiferous with a small lobe distally at the tip. Length to tip of wings 10.7 mm. Captured at some time and place as the male of *Leuctra laura*.

There is no recent key to North American *Leuctra*. *L. laura* would fit in as follows to a key to male *Leuctra* s.s. of the northeast:

1. Raised processes on both tergites 7 and 8 or processes on neither.....2
 Process on either tergite 7 or tergite 8 but not on both.....4
2. No processes on either tergite 7 or 8; or a single, rounded, hardly raised
 process on each segment.....**ferruginea**
 Processes on both tergites 7 and 8; process on 8 either bi- or trilobed.....3
3. Process bilobed on each of tergites 7 and 8.....**duplicata**
 Process trilobed on tergite 8; single, rounded, hardly raised on 7.....**laura**

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|---|-------------------|
| 4. Process on tergite 7 only..... | 5 |
| Process on tergite 8 only..... | 9 |
| 5. Process on tergite 7 distinctly trilobed..... | 6 |
| Process of tergite 7 not trilobed..... | 7 |
| 6. No spines on apices of paraprocts, titillators slightly curved or straight... variabilis | |
| Paraprocts finely spinulate apically, titillators well curved..... | triloba |
| 7. Process of tergite 7 reaching anterior margin of 8th tergite..... | 8 |
| Process of tergite 7 not reaching more than halfway across tergite 7..... | tenella |
| 8. Sclerotized process long, extending out over tergite 8; vesicle longer than wide..... | tenuis |
| Sclerotized process not extending over tergite 8; vesicle as wide as long..... | |
| | variabilis |
| 9. Tergite 8 with a single process..... | 10 |
| Tergite 8 with two processes or a single bifurcate or trifurcate one..... | 11 |
| 10. Process truncate..... | truncata |
| Process rounded and hardly raised..... | ferruginea |
| 11. Tergite 8 with a trifurcate process..... | laura |
| Tergite 8 with two processes or a single bifurcate one..... | 12 |
| 12. Process of tergite 8 with 2 slender processes widely separate and several times as long as wide; paraprocts without trough..... | sibleyi |
| Process of tergite 8 with two lobes close together; trough in paraprocts..... | maria |

There are no specific lists of timberline insects of the Rocky Mountains. However, Knight and Gaufin (1966) and Gaufin (1964) give some measure of expected stoneflies. The following stoneflies were collected from July 16 to 20 at elevations of 10,000 to 10,500 feet in the Bridger Wilderness Area of Wyoming.

Nemoura haysi Ricker—a mating pair well above timberline on a cliffside several hundred yards from the nearest water (Bear Lake).

Nemoura columbiana Claassen—above timberline at the outlet to Pass Lake.

Paraleuctra purcellana (Neave)—female among scrub willows at outlet to Faler Lake. The venation of the hindwing was not typical of *Paraleuctra* but the genitalia and abdominal sclerotization of the abdomen are distinctive.

Perlomyia utahensis Needham and Claassen—above timberline at outlet to Pass Lake.

Capnia confusa Claassen—above timberline at Bear Lake.

Capnia gracilaria Claassen—two gravid females at outlet to Faler Lake.

Alloperla lamba Needham and Claassen—outlet to Faler Lake.

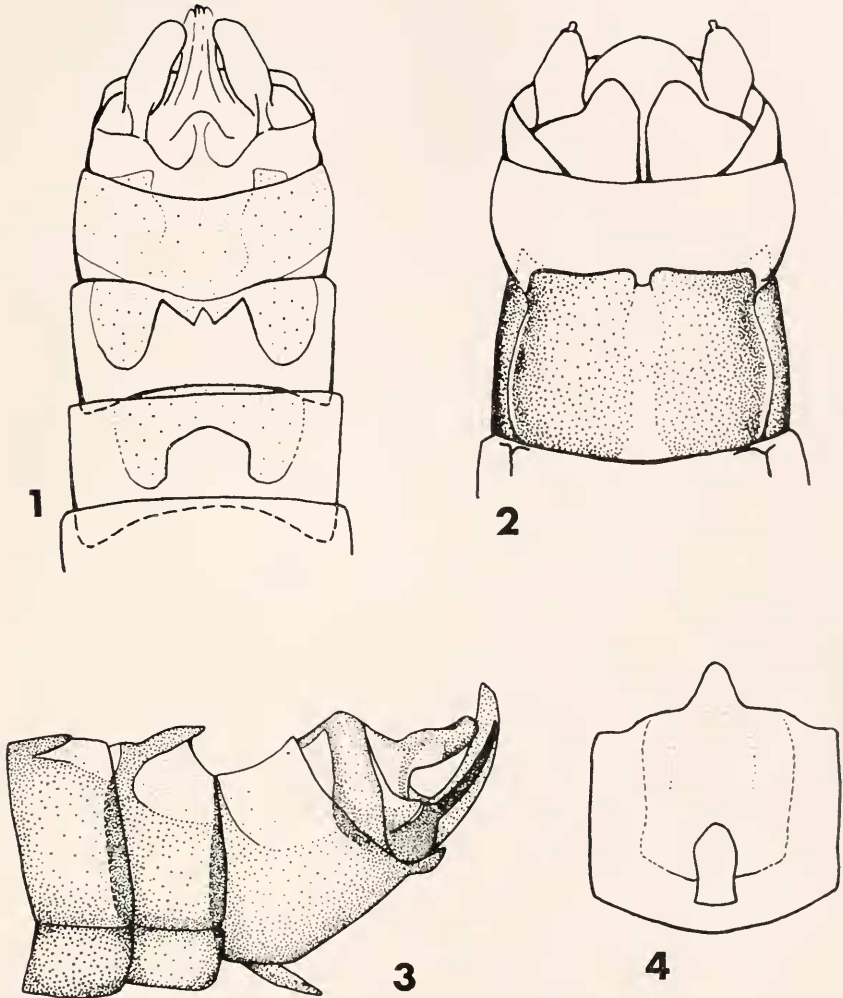
Alloperla fidelis Banks—numerous at both Faler Lake and its outlet. A female was captured ovipositing on the lake at 10 A.M.

Paraperla frontalis (Banks)—.

Arcynopteryx watertoni? Ricker—both of the above were collected in a grassy meadow with scattered trees in a pocket otherwise above timberline.

Isoperla cbria (Hagen)—Faler Lake.

The most notable thing in this list is the wide spread distribution of all these insects in the cordillera. There were no rare or restricted species. This is in strong contrast to the situation in the White Mountains. Although the Bridger area is twice the elevation of the White Mountains, the



FIGURES 1-4. 1. Dorsal view of terminal abdominal segments of *Leuctra laura* new sp. 2. Probable female of *L. laura*, ventral view. 3. Lateral view of male terminalia, *L. laura*. 4. Ventral view of male ninth sternite, *L. laura*.

weather is less rigorous and the higher life zones are continuous to the north and south. Nebeker and Gauñin (1967) present a map showing barriers and the zones of isolation in the mountainous areas of the west. These particular insects fall into the Wasatch zone with affinities to the Wasatch and Uinta Mountains and the mountains of south central Utah. However the Green River drainage has an altitudinal connection to the north through the Absaroka Mountains and two species (*P. purcellana* and

A. watertoni), not previously recorded from Wyoming (Gaufin, 1964) nor from the general Wasatch area but rather from Montana and north, were found at 10,300 feet altitude. These two species may be establishing themselves at the headwater of the Green River after having surmounted the mountain passes to the north and will eventually be found farther south. Because of the Snake River Plain barrier on the west and the desert areas of south central Wyoming on the east, the headwaters of the Green River may be the present main corridor for northern aquatic insects to make their way south into the Colorado River drainage.

At the higher, colder altitudes, stoneflies are less restricted to streams and will be commonly found in lakes as well. Many of these high country lakes contain no fish as the steep streams preclude natural movement of the fish into them. Others have been artificially stocked, usually with a single variety of trout. They thus provide a natural laboratory to examine the effects of fish on native arthropod populations. It should be possible to study undisturbed lakes as well as those subject to feeding pressure by different species of trout.

The alpine zone of the White Mountains represents an area available for colonization only since the retreat of the Wisconsin glaciation. It is an area of rigorous climate characterized by a relict plecopteran arctic fauna being occasionally invaded by more temperate species. These isolated populations of stoneflies have already shown evidence of differentiation (Brinck, 1954). The higher areas of the Rockies have been available for colonization for a longer period of time and the continuum of areas of high altitude is much greater. Consequently, stoneflies from northern areas are found extending far to the south and there is a greater population flux between zones of isolation.

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